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INSECTICIDES.

By L. E. Sayre.

SINCE the enactment of the food and drugs law there has been a tendency toward standardization of all substances in any way allied to drugs and poisons, as well as of foods and food accessories. The federal insecticide regulation No. 16 requires the ingredients of insecticides to be disclosed when containing arsenic or any of its combinations.

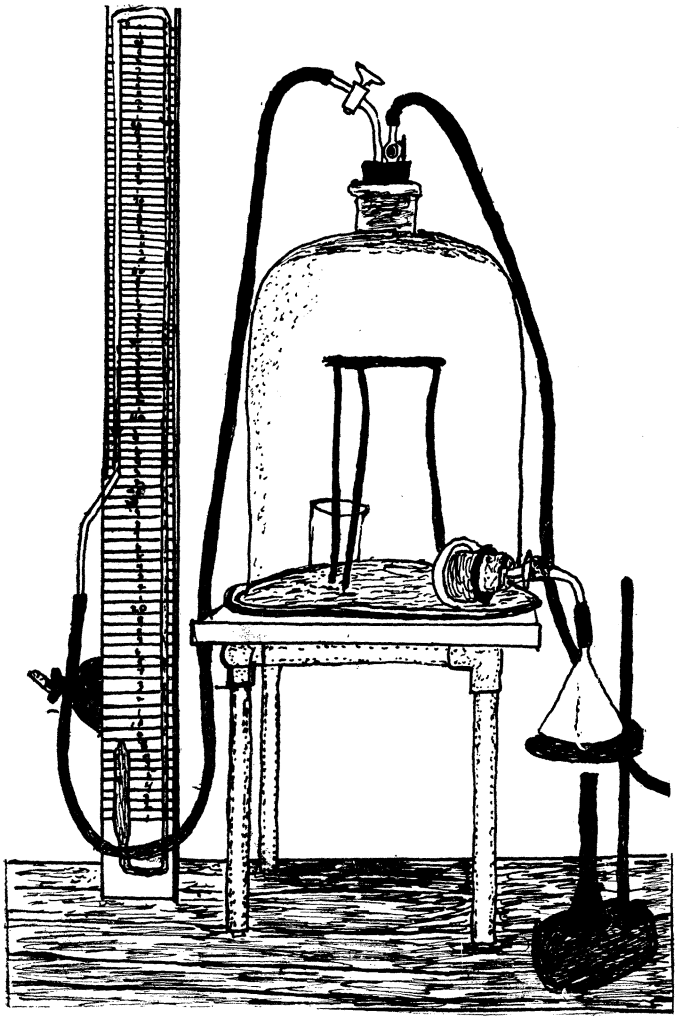
Insecticides, other than arsenical combinations, and fungicides containing inert substances which do not prevent, destroy, repel or mitigate insects or fungi, must bear a statement on the label of the name and percentage of each inert substance therein, unless the name and percentage of each active ingredient of the article is plainly and correctly stated, in which case it will be sufficient to state on the label that the article contains inert substances, giving correct percentage thereof.

Our knowledge of insecticides and fumigants up to recent times has been very inaccurate. Investigators having been drawn to the subject by the attitude occasioned by the federal and state regulations, more accurate information concerning them is now possible.

In the Journal of the American Public Health Association, 1911, there is a valuable contribution to our knowledge of insecticides by McClintock, Hamilton, and Lowe. They have in this article ably discussed the subject, and have shown the results of their investigation, giving the relative value or cofficients of the popular toxic agents employed for the extermination of insect pests. An ingenuous apparatus has been devised by them, a rough diagram of which is here reproduced.

This apparatus is so constructed as to make possible the measuring of definite amounts of gases, which may be drawn from a container for any experiment. Such gases as illuminating gas, sulphur dioxide, carbon dioxide, hydrogen sulphide, etc., have been employed. Insects confined within the glass chamber of the apparatus and subjected to the influence of various insecticides can be watched and timed, so that the relative value of toxic action can be readily estimated. The insects experimented upon by the above investigators were bedbugs, cockroaches, house flies, clothes moths, and mosquitos. It was found that the minimum quantity necessary to kill the insects varied, of course, according to the toxic

substances. For example, stating the quantity of sulphur dioxide necessary to kill the bedbug as 8, we have the quantity of formaldehyde (40 per cent solution) necessary to produce the same effect as 54 plus, making the calculated coefficient of sulphur dioxide,



Apparatus used by McClintock, Hamilton, and Lowe.

for this insect, as 1, and that of formaldehyde 0.1 The authors have tabulated in their report the coefficients of thirty-eight different insecticides, including such articles as the above mentioned, and, in addition, creosote, carbolic acid, naphthalene, kerosene, oil

of turpentine, many essentials oils, benzaldehyde, hydrocyanic acid, such powdered substances as stramonium, sabadilla, and pyrethrum, etc.

Such investigations as the above and such regulations as made by the federal government make it now almost impossible for a manufacturer to delude or deceive the public by foisting upon it any insecticide nostrum whose ingredients are kept secret unless it bears the test which recent investigations have suggested.

Our own interest has been attracted to this subject by certain insecticides being sent to the drug laboratory to obtain a statement as to their efficiency. One such article, in particular, we have recently investigated. The article is sold on the market under a trade name, and in the advertisements it is stated that this article is "creating consternation and mortality among the bugs and insects in the jails, penitentiaries and public institutions in this country. It further says that it "kills bugs instantly, and they stay dead." This article is found to contain 6.5 per cent of carbolic acid, with other ingredients which are claimed to enhance the value of this popular insecticide. Applying the test of the above-mentioned investigators in an apparatus corresponding to theirs, which we have installed, we are able to state the following facts:

Bell-jar experiments were carried out to determine the effectiveness of a few of the well-known insecticides, as well as the commercial articles mentioned. Crickets (*Gryllus*) were the insects used in these experiments, their sensitiveness to toxic substances making them particularly valuable for this kind of work. Cimicifuga (bug bane) has long been considered an effective insecticide. Our experiments with cimicifuga, however, tend to show that this drug has been greatly overestimated in its toxic properties toward insects. Powdered cimicifuga seemed to be devoid of insecticidal properties. Crickets kept in contact with the powdered drug for hours showed no toxic effect.

As a fumigant cimicifuga proved unsatisfactory, acting more as an anæsthetic than as an insecticide. One hundred times as much powdered cimicifuga as the amount of sulphur that proved effective was used, or the fumes from two grammes of the drug in a space of 9000 cc. The insects were removed after a period of one hour, apparently dead, but recovered after an hour or two hours' time.

The fluid extract of cimicifuga was tried, employing the contact method in open jar. This preparation of the drug proved more effective, killing the insects almost instantly, but it was also ob-

served that alcohol alone (which is the menstruum used in the manufacture of the fluid extract), would produce practically the same result, although recovery was noted in some cases. Aqueous preparations of cimicifuga were ineffective.

This is interesting, as cimicifuga is well known to be a plant which insects invariably shun in the open field, and hence its name — "cimic," a bug, and "fuga," to fly. This word was suggested by the peculiar property of the plant, which was in early times thought to be an insecticide.

The commercial insecticide above mentioned was tried in the same manner. By contact method in open jar it killed almost instantly. As a fumigant it had one-fiftieth of the toxic power of sulphur. This preparation, having the trade name of "Vermingo," is said to contain 6½ per cent of carbolic acid, among other ingredients. As an insecticide, however, it is superior to 6½ per cent of solution of carbolic acid by contact method, but not equal to a 6½ per cent solution of carbolic acid used as a fumigant. The vapor from the commercial article, containing considerable oil not very volatile, seems to be heavy, and does not fill the space as readily as the vapors from an aqueous solution.

Pyrethrum was tested similarly as a fumigant, and proved not to be superior to cimicifuga, the insects recovering in every instance. Employing the contact method and using the powdered drug, the usual results were obtained that every one has experienced who has used this well-known insect powder.

I am indebted to Mr. G. N. Watson for his valuable assistance in these determinations.